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REMARKS

Before discussing the rejections, Applicants deem it prudent to set forth what they consider to be their invention. Applicants' invention is a process. In particular, the invention is a process for the production of esters of organic carbonyl compounds with alcohols by carrying out an esterification reaction in the presence of a catalyst containing an inorganic phosphorus(I) compound and a titanate. The process comprises:

- (1) mixing the organic carbonyl compound and the inorganic phosphorus(I) compound to form a mixture;
- (2) filtering the mixture;
- (3) adding the alcohol and the titanate to the filtered mixture to form an alcohol-carbonyl mixture; and
- (4) esterifying the carbonyl compound in the alcohol-carbonyl compound mixture.

The remaining claims are directed to the carbonyl compounds, the alcohols, particular titanates, the phosphorus(I) compounds, the filtration and addition of an inorganic base and various parameters such as mixing times, inert gas atmosphere, particular alcohols, particular titanates and particular base.

The invention is not directed to any particular new catalyst, new alcohols or carboxylic acids. The catalyst and reactants are well known materials in the esterification art as shown in the specification. Applicants submit that one skilled in the esterification art would have no difficulty in carrying out the process with the description set forth in the specification.

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Claims 16, 20-28, 30-31 and 34 stand rejected under 35 USC 112, first paragraph, because the specification, while enabling for tetra alkyl titanates; phosphorous catalyst selected from the group consisting of phosphonic acid, hypophosphorous acid, phosphinates or hypophosphites; temperature and time of mixing from 10-220°C for at least minutes; esterification at a temperature range of 180-220°C; organic carbonyl compounds limited to fatty acid or hydroxyl fatty acid containing 8-22 carbon atoms; sodium carbonate and a filtration aid prior to filtering, does not reasonably provide enablement for all titanates or phosphorous (I) compounds; broad reaction time and temperatures; all carbonyl compounds; process lacking the steps of adding sodium carbonate and a filtration aid prior to filtering.

Claims 17-19, 29, 32-33 and 35 are objected to as being dependent upon rejected based claim but would be allowable if rewritten in independent form including all the limitations of the base claim and entering intervening claims.

Applicants respectfully request that the Examiner reconsider the rejection under 35 USC 112, first paragraph, on the grounds that the specification clearly points out the nature of the various components objected to by the Examiner.

35 USC 112, first paragraph, states:

"The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out the invention."

In addition, 35 USC 112, second paragraph, states:

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"The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the Applicant regards as his invention."

Applicants respectfully submit that the specification and claims presently in the application meet all of the requirements of 35 USC 112, first and second paragraphs. In particular, 35 USC 112, second paragraph, states that the specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the Applicant regards as his invention. (Emphasis added by Applicant)

Applicants invite the Examiner's attention to the specification which discusses each and every parameter set forth in the claims and to which the Examiner objects. In reviewing the specification, Applicants submit that the Examiner must bear in mind that the application is directed to a process for providing a reaction mixture containing a higher proportion of esterified carbonyl compounds and a mixture with improved color.

The Examiner's rejection appears to be based on the Examiner's supposition that the Applicants must claim only the best mode for carrying out their invention. Applicants submit that this has never been a requirement in the patent law since many embodiments of the invention which may differ from the best mode for carrying out the process may be suitable for many industrial applications. Applicants therefore respectfully submit that the Examiner's rejection is improper based on the teachings of the specification in defining the parameters of the claims. In reviewing the claims, Applicants suggest that the Examiner bear in mind that the claims are directed to a process and not to new and novel esters of new and novel carbonyl compounds and alcohols with the use of new and novel catalysts.

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The invention relies in the process steps involved and in particular process steps I and II which involve mixing the carbonyl compound and the inorganic phosphorus(I) catalyst to form a mixture and filtering the mixture. The mixture is then esterified by adding the alcohol and the titanate to the filtered mixture to form an alcohol carbonyl mixture and esterifying the carbonyl compound in the alcohol-carbonyl compound mixture.

Applicants submit that as set forth in the specification, the steps of first forming a mixture of the carbonyl compound and the phosphorus(I) catalyst and filtering the mixture is novel and not shown in the prior art. Applicants deem these steps to provide the improved color of the product of the process and the lower acid number.

Applicants invite the Examiner's attention to page 3, heading, Organic carbonyl compound. At page 3, beginning at line 19, the specification teaches:

"The process according to the invention is not confined to the production of certain esters. Basically, any esterifiable organic carbonyl compounds may be used, including carboxylic acids or carboxylic acid derivatives, more particularly carboxylic anhydrides, carboxylic acid halides, carboxylic acid salts, carboxylic acid amides or carboxylic acid esters. Whenever carboxylic acids in general are mentioned hereinafter as starting compounds for the esterification reaction, the above-mentioned derivatives of the corresponding acid are always understood to be included."

Applicants respectfully submit that the definition of the organic carbonyl compounds as any esterifiable organic carbonyl compound clearly supports the claims.

At page 4, under the heading, Alcohol, beginning at line 20, the specification teaches:

"However, the process according to the invention is not confined to the alcohols described in EP 0 766 661 B1 as one of the starting components of the esterification reaction. Basically, any mono- and polyhydric alcohol may

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be used. The esterification reaction is preferably carried out using a polyol. Polyols containing 2 to 12 and more particularly 2 to 8 hydroxyl groups are preferred. Particularly preferred polyols are polyalkylene glycols, more especially polyethylene glycols, and also glycerol and polyglycerols."

Applicants respectfully submit that the definition of the alcohols useful in the practice of the present invention is broad and refers to esterifiable alcohols as understood in the art. Applicants therefore respectfully submit that the claims are fully supported in the specification.

In addition, the section Alcohol describes the quantity of organic carbonyl compound and alcohol used in the process according to the invention and states that it is not particularly limited either and may be within the typical range of esterification reactions of the starting components. Besides complete esterification of the hydroxyl groups available, partial esterification thereof is also possible. A suitable molar ratio of organic carbonyl compound to alcohol is for example 1:1 to 30:1 more particularly 1:1 to 20:1 and in particularly preferred embodiments 1:1 to 15:1.

At page 5, beginning at line 7 under the heading Titanate, the specification teaches:

" Basically, the titanate may be selected from any of the titanates already known as esterification catalysts. According to the invention, titanates capable of forming esters with the alcohol used are preferred. Preferred titanates are tetraalkyl orthotitanates, more particularly tetraisopropyl titanate and tetrabutyl titanate. Suitable quantities of titanate are, for example, 0.01 to 0.1% by weight, based on the total quantity of organic carbonyl compound, alcohol and catalyst in the reaction mixture. Too large a quantity of titanate can lead to unwanted discoloration of the ester obtained; too small a quantity can slow the esterification reaction."

Applicants therefore respectfully submit that the nature and the quantities of the titanates set forth at page 5 would clearly teach one skilled in the art the nature of the

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titanates which can be utilized and the amounts which are preferably utilized to form the reaction with the low acid value and the light color.

Again, Applicants submit that the titanate catalysts are well known in the art and to Applicants' knowledge, any of the known titanate esterification catalysts and in particular titanates which form esters with the alcohol are most preferred. Applicants submit that the specification clearly supports the claims as presently in the application.

At page 5, beginning at line 19 under the heading Phosphorus(I) compound, the specification teaches:

"Basically, the phosphorus(I) compound may also be selected from any of the phosphorus(I) compounds already known as esterification catalysts. According to the invention, preferred phosphorus(I) compounds are phosphorus(I) acid (i.e. phosphinic acid, hypophosphorous acid) or salts of phosphorus(I) acid (phosphinates, hypophosphites). Suitable quantities of the phosphorus(I) compound are 0.1 to 1% by weight, based on the total quantity of organic carbonyl compound, alcohol and catalyst in the reaction mixture.

In a first step of the process according to the invention, the organic carbonyl compounds and the inorganic phosphorus(I) compound are mixed for at least 20 minutes at a temperature of 20 to 220°C, preferably at a temperature of 60 to 180°C and more particularly at a temperature of 80 to 120°C. The mixing times are temperature-dependent and are typically between 15 and 180 minutes. Mixing times of 30 to 60 minutes at temperatures of 80 to 120°C are preferred."

Applicants therefore respectfully submit that the specification clearly supports the limitations in the claims.

At page 6, beginning at line 6, under the heading Inorganic base, the specification teaches:

"Particularly good results in regard to the color of the esterification product

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obtained are achieved if an inorganic base is added to the mixture of organic carbonyl compound and inorganic phosphorus(I) compound before the filtration step. In a particularly preferred embodiment, the inorganic base is a basic salt, more particularly a carbonate such as, for example, sodium or potassium carbonate. The inorganic base is preferably added in a quantity sufficient to neutralize the phosphorus(I) compound substantially completely.

Accordingly, the inorganic base is preferably added in an equivalent quantity to the phosphorus(I) compound used, although it may also be added in excess in relation thereto.

The advantage of adding an inorganic base presumably is, on the one hand, that, as a result of the pre-neutralization, the reaction mixture is not too acidic in the subsequent esterification step, so that a higher degree of esterification can be achieved. On the other hand, where an inorganic salt is added, the salt presumably acts as a filtration aid and thus improves the purifying effect of the filtration step."

Applicants respectfully submit that the section on Inorganic bases fully sets forth the types of materials which are preferably utilized in the process and the rationale behind their inclusion in the process. Applicants therefore respectfully submit that the claims are fully supported in the specification in regard to the inorganic bases.

At page 6, beginning at line 24, under the heading Filtration aid, the specification teaches:

"Alternatively to or in addition to adding an inorganic salt, a filtration aid may be added to the mixture of organic carbonyl compound and inorganic phosphorus(I) compound before the filtration step. Basically, any mildly alkaline to mildly acidic known filtration aids, such as bleaching earths for example, are suitable. Suitable filtration aids are commercially available, for example, under the names of "Hyflow® Supercel" (Manville Corp.) or "Tonsil® Standard" (Südchemie). These filtration aids enhance the purifying effect of the filtration step and thus contribute towards reducing color in the end product.

The process according to the invention may be carried out either in the melt phase or in solution. From the cost and environmental perspectives, the process is preferably carried out in the melt. However, the reaction may also

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be carried out in a nonpolar, inert organic solvent. Particularly preferred solvents are those which form an azeotrope with the water of esterification formed, accompanied by a reduction in boiling point, such as toluene or xylene for example. The particular procedure selected in the esterification process according to the invention is primarily determined by the educts selected. The choice of suitable process parameters, such as the choice of suitable solvents and the choice of the reaction temperatures, is known in principle to the expert."

At page 7, the specification further teaches that:

"In order to minimize discoloration of the end product, the esterification temperature selected during the process according to the invention is as low as possible. Where it is carried out in the melt, the esterification reaction preferably takes place at a temperature below 240°C and more particularly at a temperature of 180 to 220°C. Beyond a temperature of ca. 170°C, rapid discoloration is normally observed in the esterification step of the process according to the invention where phosphorus(I) acid or a salt thereof is used as the phosphorus(I) compound. This is presumably attributable to the decomposition of the phosphorus(I) acid which – via intermediate stages – forms phosphane and phosphoric acid which ultimately leads to bleaching of the reaction mixture."

This and other statements at pages 7 and 8 clearly teach one skilled in the art how to obtain the optimum yields from the reaction mixture. Examples 1 and 2 at page 8 disclose use of different orthotitanate catalysts and the use of sodium carbonate and the filter aid HYFLOW® Supercel. Examples 1 and 2 were carried at a maximum temperature of 210°C rather than the 240°C for comparison Examples 1-4. In comparative Examples 1-4, the addition of the neutralizing agent and the filter aid occurred after the esterification had been completed and provides a product with a much higher color and higher acid value.

Applicants submit that the use of filter aid at least in the best mode shown aids in improving the color of the product. However, one skilled in the art would know that the use

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of filter aids to improve filtration can be obviated if one skilled in the art is willing to utilize finer filter media with longer filter times.

The Examiner's rejection appears to be based on her understanding that Applicants are required to claim only the best mode for carrying out the process. Applicants submit that this is not a proper grounds for rejection under 35 USC 112. Applicants make this statement in view of the extensive description of the various components which are utilized in the process and the particular preferred reaction temperatures and times. Applicants submit that the claims as written cover the preferred embodiments and the best mode known to Applicants at the time the application was filed, the specification is sufficient to teach one skilled in the art how to make and use the process of the invention.

Applicants invite the Examiner's attention to 35 USC 112, second paragraph, which states that the specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the Applicant regards as his invention.

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In view of the specification and the claims, Applicants respectfully submit that the claims clearly comply with 35 USC 112, first and second paragraphs. Applicants therefore respectfully request that the Examiner reconsider and withdraw the rejection. Applicants respectfully request favorable consideration and allowance of the application.

Respectfully submitted,



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